Personnel Selection and Training
Bulletin, Vol. 3, No. 4

QUALITY CONTROL OF INSTRUCTION AND INSTRUCTIONAL DEVELOPMENT[1]

by

John A. Ellis and Wallace H. Wulfeck, II
Navy Personnel Research and Development Center

Dec 1982

The Instructional Quality Inventory (IQI) is a set of quality control or evaluation procedures for the three main parts of an instructional program; the objectives, tests, and instructional materials or presentations. The procedures can be used for quality control during the instructional development process or can be used to evaluate existing instructional programs. The IQI procedures can also serve as standards for instruction developed under contract.

The initial work on the IQI was done under contract to the U.S. Navy Personnel Research and Development Center (NPRDC) by Courseware, Inc. (Merrill, Wood, Richards and Schmidt, 1977). The initial version was extensively revised and field tested by NPRDC, and a final version was published in 1979, (Ellis, Wulfeck, and Fredericks, 1979).

THE IQI CLASSIFICATION SCHEME AND PROCEDURES

The IQI was initially designed to parallel and supplement the military's Instructional Systems Development model (Branson, Rayner, Cox, Furman, King, and Hannum, 1975). However, it can be applied to any systematically developed program of instruction. The procedures are based on a system for classifying objectives, test items, and instructional presentations.

Classification schemes have been used in the past with some success but there have always been problems. In order for a classification scheme to be useful two conditions must be met. First, instructional and test developers must be able to make reliable classifications using the scheme. Second, the scheme must have clear implications for instructional and test item development; the implications should be specified as prescriptions for development. Typically, classification procedures are too loosely defined (e.g., Gagne, 1976; Popham, 1977) to permit reliable classification by users who have not had considerable training or who are not highly sophisticated instructional designers.

Military instructor personnel have difficulty using schemes of this nature, yet they do the majority of instructional and test development. In addition, the implications for

[1]Portions of this article were presented at the American Psychological Association meeting in Los Angeles 1981. The opinions or assertions contained herein are those of the writers and are not to be construed as official or reflecting the views of the Navy Department.

instruction and testing are often not clearly specified (Briggs 1977). Merrill, Richards, Schmidt, and Wood (1977) developed a classification scheme for use by U.S. Navy instructional developers. The scheme was tested and extensively revised (Ellis & Wulfeck, 1979) and is currently being used by Navy personnel. In its present form, it meets the two conditions listed above (Ellis & Wulfeck, 1981).

Classification of objectives is necessary for several reasons. First, it helps make more precise judgments about the accuracy of learning objectives and leads to more precise test item specifications. It also helps make judgments about how consistent objectives and test items are with each other. If we didn't classify objectives and test items, all we could say is, "This is an objective and this is a test item, and they don't look too different." The classification scheme allows us to insure that objectives, test items, and the corresponding instruction all address the same thing. The classification scheme also helps us to judge whether or not objectives and test items, and instructional presentations are adequate.

The Classification Scheme

Objectives and test items can be classified according to: (1) What the student must do; that is, the task to be performed, and (2) the instructional content; that is, the type of information the student must learn.

The Task Dimension

A student can either remember information, or use the information to do something. This distinction corresponds to the difference between knowledge and application, and to the difference between declarative and procedural knowledge. The following two test items illustrate the remember-use distinction.

a. Remember: The symbol for resistor is _____.

b. Using your knowledge of electronic theory, predict what would happen in the circuit shown below if the load resistance were shorted?

These two test items differ with respect to what the student is supposed to do (Task). In the first item, the student has to remember something. In the second, he has to apply or use his knowledge in a new situation.

The Content Dimension

There are five types of content; facts, categories, procedures, rules, and principles. Facts are simple associations between names, objectives, symbols, locations, etc. Facts can only be remembered while the other content types can be remembered or used. Categories are classifications defined by certain specified characteristics. Procedures consist of ordered sequences of steps or operations performed on a single object or in a specific situation. Rules also consist of ordered sequences of operations, but can be performed on a variety of objects or in a variety of situations. Principles involve explanations, predictions or diagnoses based on theoretical or cause-effect relationships.

Facts can only be remembered, but for the other content types, the student may be asked to use his knowledge to classify, perform, solve, or predict.

The use level can be further

divided into two types: (1) Use-Unaided, where the student has no aids except his own memory, and (2) Use-Aided, where the student has a job aid to perform the task. For the use-aided type, the nature of the aid depends on the content type. For use-aided category, the aid consists of a decision strategy including each critical characteristic. In simple cases, when the aid may comprise only a list of characteristics, the decision strategy would be implied. For use-aided procedures, the aid is a list of steps to be performed. For use-aided rules, the aid is at least a statement of the formula or rule to be applied, and could include guidelines for when and how to apply it. For use-aided principles, the aid is also at least a statement of the principle, and could include guidelines for when and how to apply it. In summary, the remember level involves "pure" remembering; the use-unaided level, remembering what is to be used and then using it; and the use-aided level, "pure" using.

An Overview of the IQI Procedures

The IQI consists of five procedures. Since all the steps of the instructional development process depend on careful specification of learning objectives, the first procedure is to assure the *adequacy* of objectives. This is done by classifying each objective, determining whether all the necessary conditions, standards, and actions are present, and judging whether or not the objective accurately reflects what the student is supposed to do or know following training.

The next two procedures involve checking test items. First, test item(s) are evaluated against their corresponding objectives to ensure that the test items are *consistent* with the objectives. This is accomplished by making sure that the conditions, standards, and actions for the test items are the same as those for the objective, and by checking to see that each test item is classified in the same way as its objective. Next, the adequacy of the test items is assessed by determining whether each item conforms to the rules for proper item construction.

The final two procedures are concerned with the instructional presentation. The term "instructional presentation" covers all the ways instruction can be presented. This includes printed self-study materials, lectures, computer-assisted instruction, films or videotapes, tape-slide presentations, audio tapes, videodisc, one-on-one tutorials, and any combination of these.

At this point, the objectives and test items for the instructional program are consistent with each other, and are adequate. The next step is to make sure that the instructional presentation is *consistent* with the objectives and test items. For a presentation to be *consistent* with an objective/test item, it must teach to the task level and content type of the objective/test item. This means that the presentation must contain certain components, depending on the task/content level. There are four main presentation components: statements, examples, practice remembering and practice using. For statements the student is given a statement of fact, a category definition, the steps of a procedure or rule, or a statement of a principle. For examples the student is told or shown how a statement of a category, procedure, rule, or principle applies in a specific case. For practice remembering the student is asked to supply part or all of a fact statement, category definition, the steps of a procedure or rule, or a statement of a principle. The student is also given feedback about the correctness of his answer. For practice using the student is asked

to use a category definition, procedure, rule, or principle on a specific case to which it applies, and is given feedback about the quality of his performance. Different combinations of these components are required, depending on the task level of the objective. A component is counted as present in the instruction only if it is complete. This depends on the content type of the objective, and simply means that everything that needs to be included is included.

Instruction can be consistent, but still not teach as effectively as it could. The final procedure evaluates the *adequacy* of the instructional presentation. The adequacy procedure incorporates a number of instructional design principles which have been shown to promote student learning. These include guidelines for formatting information so students can find it, for communicating it clearly and effectively so students can understand it, and for including additional explanation, so students can better learn and remember the information.

CONCLUDING STATEMENT

The IQI consists of four volumes: I. Introduction and Overview (Wulfeck, Ellis, Richards, Wood, and Merrill, 1978), II. Users Manual (Ellis, Wulfeck, and Fredericks 1979), III. Training Workbook (Fredericks, 1980), and IV. Job Performance Aid (Ellis and Wulfeck, 1978). All of these documents can be obtained from the Defense Technical Information Center, Cameron Station, Alexandria, Virginia. The appropriate access numbers are given in the reference section. Further information can be obtained by writing John Ellis or Wallace Wulfeck at Code 13, Navy Personnel Research and Development Center, San Diego, California 92152.

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PROSPECTS FOR ENERGY FROM COAL SAID TO BE BETTER THAN FROM NUCLEAR

A study sponsored jointly by the U.S. Department of Energy and the U.S. Department of Labor expects a decline in construction of nuclear plants after this year (1982), with construction declining to zero by the mid-1990s. By the year 1995 plants using coal are expected to comprise 92 percent of power plants under construction. The study was conducted by Dr. Roger Bowlby, University of Tennessee Professor of Economics, and Drs. Soon Paik and William Schriver, U.S. Department of Labor economists. A summary of the report was included in the TORCHBEARER, a publication of the University of Tennessee at Knoxville.